TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

External Assessment 2026

Attach your candidate label here

GENERAL MATHEMATICS

MTG315123

Section A Mathematical and Statistical Models

Pages: 16

Questions: 6

Information Sheet: 1

Preparation time for this exam: 15 minutes

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
  - Spare diagrams have been provided at the end of this section. Indicate using the box provided if you have used the spare diagram.
- TASC approved calculators can be used throughout the exam.
- The exam is **three (3) hours** in length. The suggested working time for this section is **approximately 36 minutes**.
- The General Mathematics Information Sheet can be used throughout the exam.
- All answers must be written in **English**.
- You **must** make sure your answers address the listed criterion.

Marker use	
C3	/ 36

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Guide to Exam Structure

	Parts	Questions available	Questions to answer	Suggested working time	Marks available
Section A		6	6	36 minutes	36 marks
Section B		4	4	36 minutes	36 marks
Section C		5	5	36 minutes	36 marks
Section D		4	4	36 minutes	36 marks
Section E	Part 1 **OR**	5	5	36 minutes	36 marks
	Part 2	4	4	36 minutes	36 marks
Totals		**28**	**24/23**	**180 minutes (3 hours)**	**180 marks**

Additional Exam Instructions

For questions worth **one (1)** mark, you are not required to show workings. Markers will look at the presentation of the answer(s) and at the argument(s) leading to the final answer(s). For questions worth **two (2)** or more marks **you are required** to show relevant workings.

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- for suitable justifications and explanations of methods and processes when requested.

Criterion

You **must** make sure your answers address:

- Criterion 3 apply mathematical and statistical models to investigate, represent and analyse real-world situations and solve problems.

Question 1

Marker use

A college student surveys her peers about what brand of phone they have against what music platform they use.

They obtain the following results:

	Brand A	Brand I
Platform S	29%	67%
Platform Y	71%	33%
Totals	100%	100%

Table 1

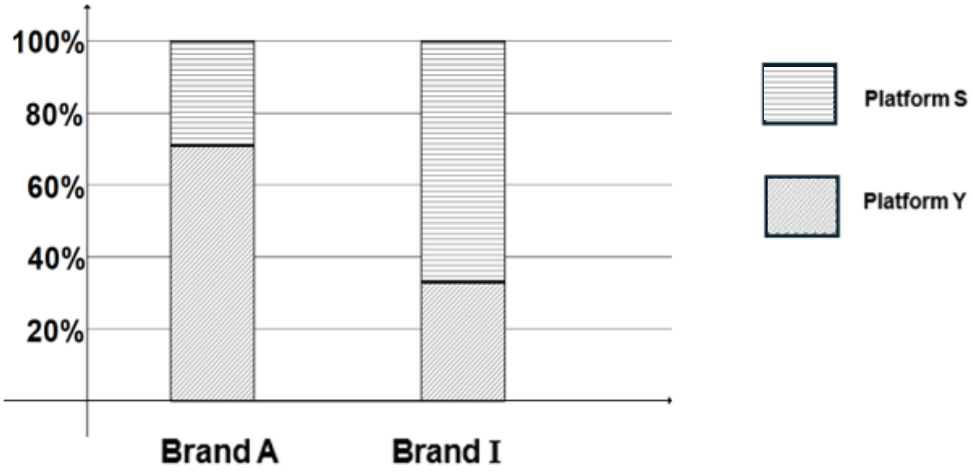


Figure 1

a) Is there an association between the brand of mobile phone used and the music platform used by these students? Justify your answer using data from the survey.

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Question 1 continues

Marker use

b) The owners of Platform S want to know how to best spend their marketing money to achieve the highest possible total sales. With reference to Table 1 and Figure 1, how would you advise them?

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Total Q1

/5

Question 2

Marker use

The number of international cruise ships visiting a city port each season is recorded and the results are as follows:

Year	Spring	Summer	Autumn	Winter	Average
2022-23	12	70	14	1	24.25
2023-24	16	67	10	2	
2024-25	14	68	8	3	23.25

Table 2

Spare diagram used (X) ☐

a) The "Average" column is the average number of cruise ships visiting for each season over that year (July to June). Complete the missing value in Table 2. /1

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Alan, an analyst, deseasonalises the data and his results are shown below.

Table 3 gives the index values for each season, to three (3) decimal places.

Year	Spring	Summer	Autumn	Winter
2022-23	0.495	2.887	0.577	0.041
2023-24	0.674	2.821	0.421	0.084
2024-25	0.602	2.925	0.344	0.129
Quarterly Index	0.590	2.878	0.447	

Table 3

Spare diagram used (X) ☐

b) Calculate the missing value in Table 3, to **three (3)** decimal places. /1

.....

In Table 4, the following deseasonalised values are produced:

Year	Spring	Summer	Autumn	Winter
2022-23	20.331	24.331	31.286	11.789
2023-24	27.108	23.284	22.347	23.578
2024-25	23.720	23.632	17.878	35.366

Table 4

Question 2 continues

Question 2 continued

Marker use

Alan produces a graph of the original versus deseasonalised data.

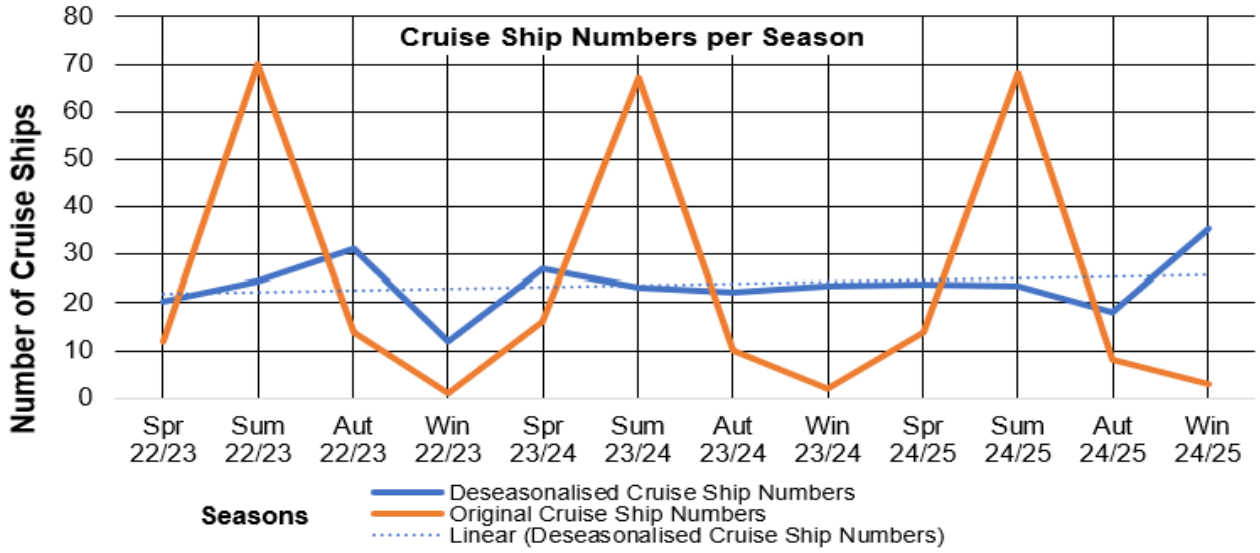


Figure 2

He finds that the linear trendline for the data can be given by the equation

$$C = 0.356S + 21.405$$

where S is the season and C is the number of cruise ships.

c) Use this trendline to predict the **actual** number of cruise ships visiting in the summer of 2026/27, which is Season 18. /2

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d) Alan uses this data to justify the claim that the number of cruise ships visiting the port is increasing over time. /3

A second analyst, Beth, says that the number of cruise ships visiting is falling over time. What evidence would you use to support Beth's argument? What do you believe caused the data to lead to Alan's conclusion?

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Total Q2 /7

Question 3

Marker use

The number of data centres world-wide, mainly used for AI, has increased according to Table 5:

Year	Years After 2014	Number of Data Centres
2015	1	6 500
2021	7	8 600
2024	10	10 200
2026	12	10 900

Table 5

Two (2) models are proposed to predict the growth in the number of data centres:

Arithmetic Sequence Model: $A_n = 5000 + 500n$,

Geometric Sequence Model: $G_n = 6150 \times 1.049^n$,

for n the number of years after 2014.

a) Using both models, complete Table 6.

/2

Year	Years since 2014	Number of Data Centres	Arithmetic Sequence Model	Geometric Sequence Model
2015	1	6 500	5 500	6 451
2021	7	8 600	8 500	8 596
2024	10	10 200	10 000	9 923
2026	12	10 900		

Table 6

Spare diagram used (X) ☐

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Question 3 continues

Marker use

The World Bank has predicted that “numbers of data centres will not continue to increase exponentially, instead the focus will be on building larger data centres”.

b) What type of growth do the Arithmetic Sequence Model and the Geometric Sequence Model exhibit? With this in mind, which of these models is the most appropriate?

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Total Q3

/5

Question 4

Marker use

A charity has organised a fundraising event where participants will complete 5 000 push-ups in 30 days.

Norm would like to enter, but currently he is not very fit.

a) If he completes 12 push-ups on the first day, then increases the number by 10 each day, how many push-ups will Norm complete in 30 days? Show algebraic working. /2

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b) If Norm still wants to increase the number of push-ups by 10 each day, what is the minimum number he must complete on the first day so as to reach the target of 5 000 push-ups in 30 days? /2

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c) Norm completes his 2 500th push-up during the 21st day. He will complete the remaining 2 500 push-ups over the next 9 days. /3

Given that the number of pushups completed is an arithmetic sequence, explain why the total does not increase linearly.

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Total Q4 /7

Question 5

Marker use

Sally bought a vase 35 years ago for $100. She just appeared on *Antiques Roadshow* with the vase, where it was valued at $3 200.

a) If Sally had invested the $100 at 10% p.a. compounding monthly for 35 years instead, would the vase or the investment be worth more? /2

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b) Sally remembers being offered $2 000 for the vase in the past. If the investment from item a) was worth less than $2 000 at that time, determine the **latest possible year** in which this offer could have been made. /3

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c) If inflation has averaged 3.5% p.a. (calculated annually) for the 35 years, how much profit, in real terms, has she made by buying and selling the vase? /2

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Total Q5 /7

Question 6

Marker use

Fred has 10 years remaining on his home loan, with the current balance being $300 000. It has an interest rate of 4% p.a. charged quarterly.

Fred's repayments on his loan are $9 136.68 per quarter.

a) For the remaining 10 year period, write Fred's loan in terms of a recurrence equation, in the form:

/2

$$t_{n+1} = rt_n - d, \text{ where } t_0 = a.$$

Recall that:

- t_n is the amount owing on the loan after n payment periods
- r is the growth in the amount owing due to interest
- d is the repayment each period
- a is the initial amount of the loan.

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b) Fred is struggling financially to make his quarterly payments on his loan. The bank offers to help him by making his loan an 'Interest Only Loan' for the next 2 years.

Fred will only have to repay the amount of interest charged over the next 2 years. Then his repayments will return to normal for a further 10 years.

i. What will Fred need to pay each quarter during his Interest Only Loan?

/2

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ii. How much extra will Fred pay to the bank over the life of the loan?

/1

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Total Q6

/5

Spare Diagrams

Question 2 a)

Year	Spring	Summer	Autumn	Winter	Average
2022-23	12	70	14	1	24.25
2023-24	16	67	10	2	
2024-25	14	68	8	3	23.25

Table 2

Question 2 b)

Year	Spring	Summer	Autumn	Winter
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2024-25	0.602	2.925	0.344	0.129
Quarterly Index	0.590	2.878	0.447	

Table 3

Question 3 a)

Year	Years since 2014	Number of Data Centres	Arithmetic Sequence Model	Geometric Sequence Model
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2021	7	8 600	8 500	8 596
2024	10	10 200	10 000	9 923
2026	12	10 900		

Table 6

End of Section A

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TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

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GENERAL MATHEMATICS

MTG315123

Section B Bivariate Data Analysis

Pages: 16
Questions: 4
Information Sheet: 1

Suggested working time: 36 minutes

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Marker use	
C5	/ 36

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Criterion

You **must** make sure your answers address:

- Criterion 5 interpret concepts and apply mathematical techniques to solve problems involving bivariate data analysis and time series analysis using the statistical investigation process.

Question 7

Marker use

The maximum temperature in Hobart for the last seven (7) days in April this year is recorded.

Date in April 2026 (d)	Max Temp (T) (°C)
24	24
25	23
26	27
27	21
28	21
29	17
30	22

Table 7

a) Calculate a line of best fit for the data in the form $T = ad + b$. Give your answers to **two (2)** decimal places. /2

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A plot of the residual data is shown in Figure 3.

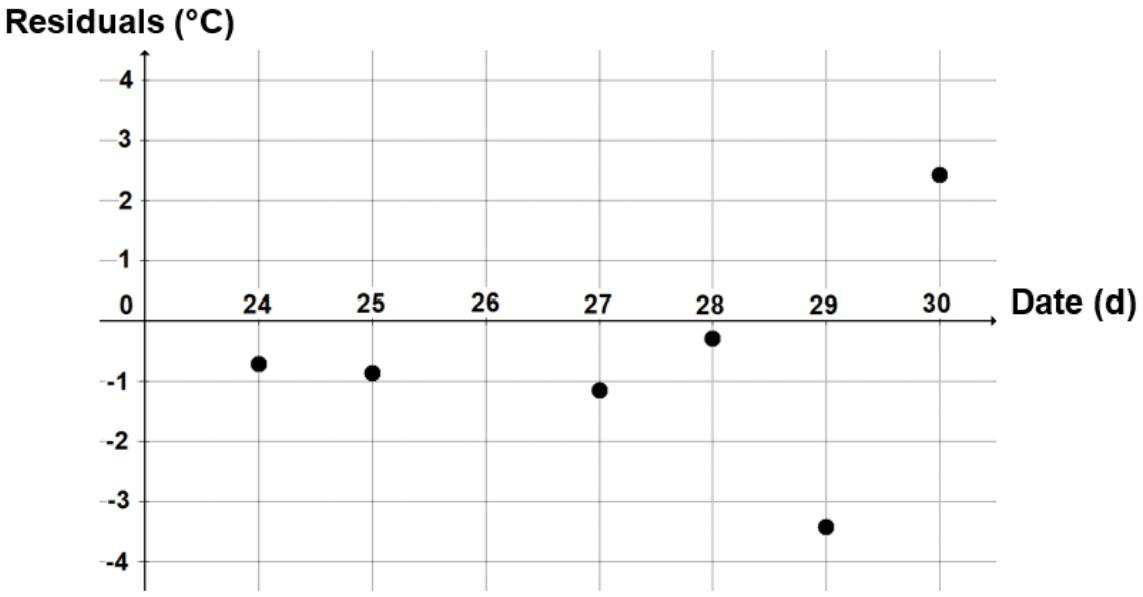


Figure 3

Spare diagram used (X) ☐

b) Find the residual value for the 26th of April and add it to the graph in Figure 3. /1

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Question 7 continues

Marker use

/3

c) It is suggested that the temperature of 27°C on the 26th of April is an outlier. Do you agree with this? Under what circumstances can the data be removed?

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Total Q7

/6

Question 8

Marker use

The Dow Jones Index is a measure of the worth of the United States stock market.

A 3-point moving average is made for the data, rounding to the nearest whole number.

Date in May 2026	Dow Jones Index (Points)	3-Point Moving Average (Points)
1	49499	
2	49156	49288
3	49208	49102
4	48941	
5	49298	49383
6		49601
7	49596	49705
8	49609	

Table 8

Spare diagram used (X) ☐

a) Add the missing values to Table 8. /2

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Question 8 continues

Marker use

A graph with the 3-point moving average values is shown in Figure 4.

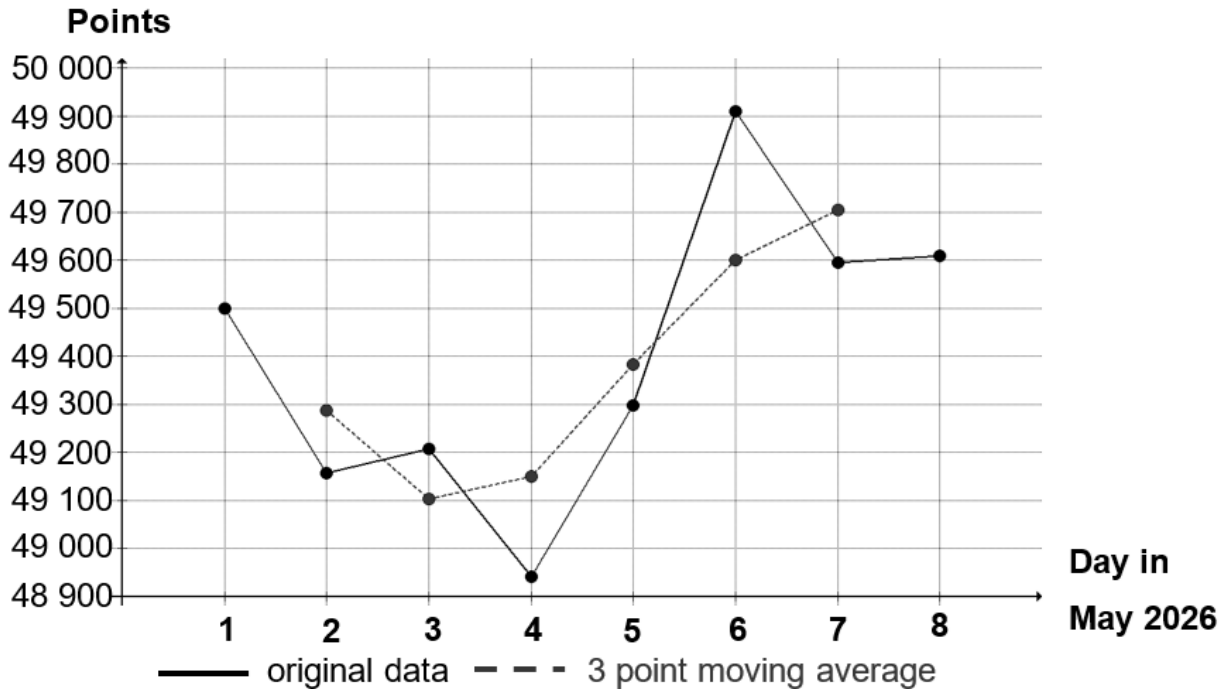


Figure 4

b) Describe the trend of the **original data** during the 8-day period. Is there evidence of a **linear** trend in the data?

/2

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c) There is some evidence of an upwards linear trend in the **3-point moving average**. Use this information to suggest trends (if any) in the original Dow Jones data.

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Total Q8

/6

Question 9

Marker use

A teacher surveys ten (10) random students in their General Maths 3 class to determine the number of hours they studied before their mid-year exam. The teacher then matches this data with their result in Table 9:

Observation	Hours Studied (H)	Mid-year Results (M%)	x^2	xy
1	4	37	16	148
2	8	89	64	712
3	2	27	4	54
4	6	47	36	
5	4	25	16	100
6	1	21	1	21
7	9	92		828
8	4	58	16	232
9	7	89	49	623
10	10	93	100	930
Totals:	55	578	383	3930

Table 9

Spare diagram used (X) ☐

a) Calculate the **two (2)** missing values in Table 9. /1

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b) Use the linear regression formulae to show that the line of best fit for the data is /4

$$M = 9.330H + 6.489$$

to **three (3)** decimal places.

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Question 9 continues

Marker use

The teacher draws a graph of the data but does not get time to complete it.

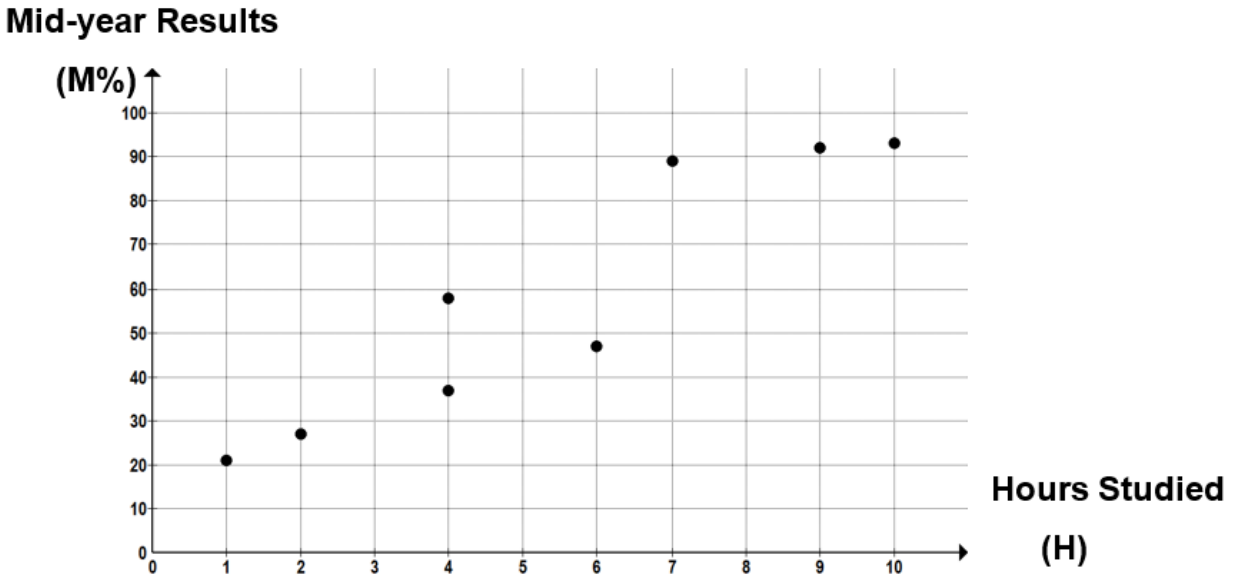


Figure 5

Spare diagram used (X) ☐

c) Add the observations 2: $(8, 89)$, and 5: (4, 25) to Figure 5. /1

The calculator gives a value of $r^2 = 0.8468$ for the data.

d) Explain the value for r^2 in the context of the data. /2

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Question 9 continues

Marker use

e) Next year's mid-year exam is expected to have the same level of difficulty. Recall that the line of best fit for the data is $M = 9.330H + 6.489$.

i. A student plans to study five (5) hours for the mid-year exam next year. What mark would you predict they would score? /1

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ii. How many hours should a student study next year to pass, if the pass mark next year is 45%? /1

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f) Using the r^2 value and looking at the data, would you say the results in item e) i. and item, e) ii. are reliable? Justify your answer /2

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g) The teacher claims that, "more study causes higher results". Would you agree with this claim? /3

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Total Q9 /15

Question 10

Marker use

A major waterfront infrastructure development is completed. The value of houses (to the nearest $50 000) and the distance to the coast (in hundreds of metres) is sampled from eight (8) random properties in a suburb.

House Price Values (V) (X $100 000)	Distance to Coast (d) (X 100 m)
12	1
8	5
5.5	7
7	6
6.5	8
7.5	12
6	16
5.5	19

Table 10

a) What is the independent variable in this situation? Explain why. /2

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The data is graphed in Figure 6, along with the line of best fit for the data.

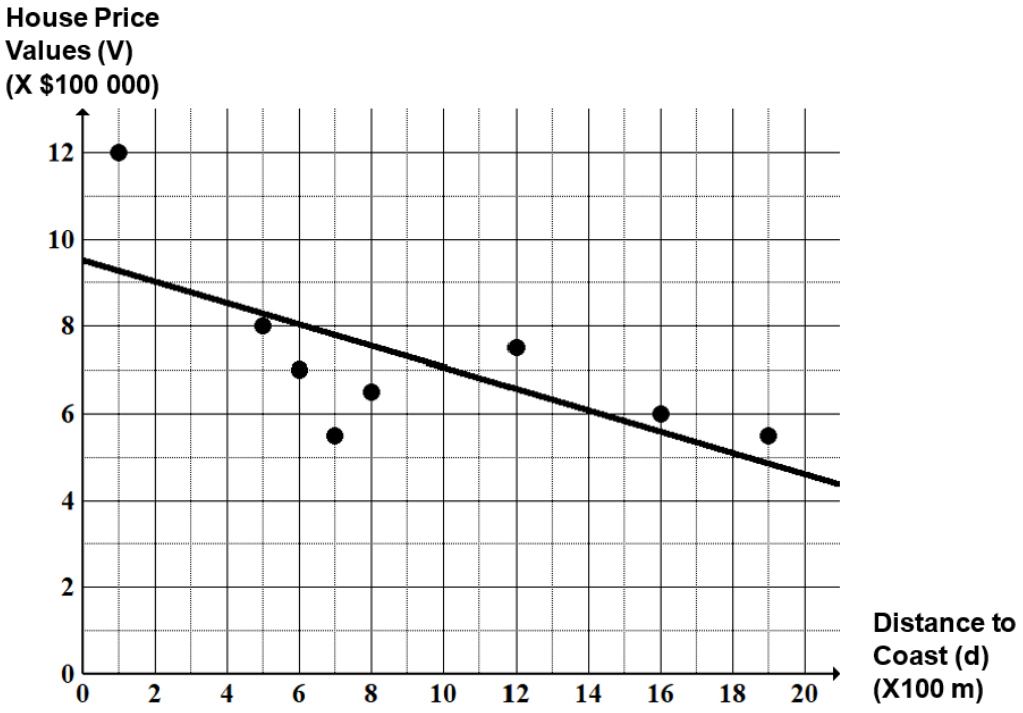


Figure 6

Question 10 continues

Marker use

The equation of the line of best fit is given by $V = -0.245d + 9.512$, where d is the distance to the coast (in hundreds of metres) and V is the house value (in hundreds of thousands of dollars).

b) Interpret the gradient in terms of the variables. /2

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c) The correlation coefficient for the data is $r = -0.691$. Explain this value in the context of the data. /2

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Marker use

A graph of the residuals is shown in Figure 7.

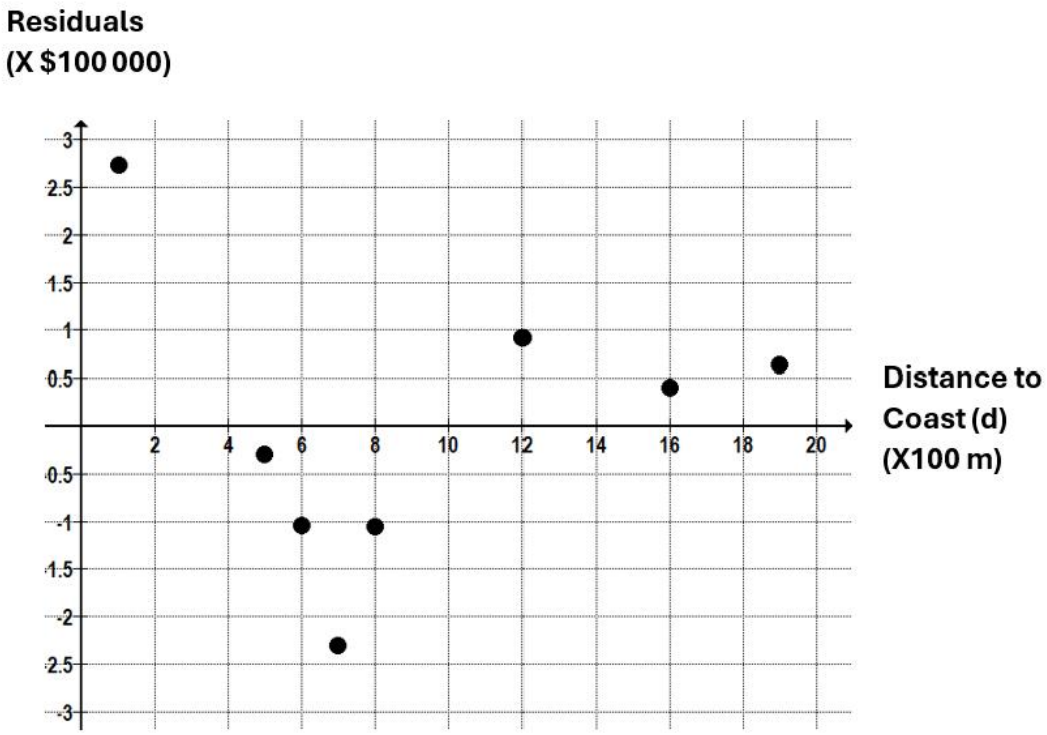


Figure 7

d) Using the information in this graph and the correlation value ($r = -0.691$), decide if a linear model is appropriate for the data.

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Total Q10

/9

Marker use

Question 7 b)

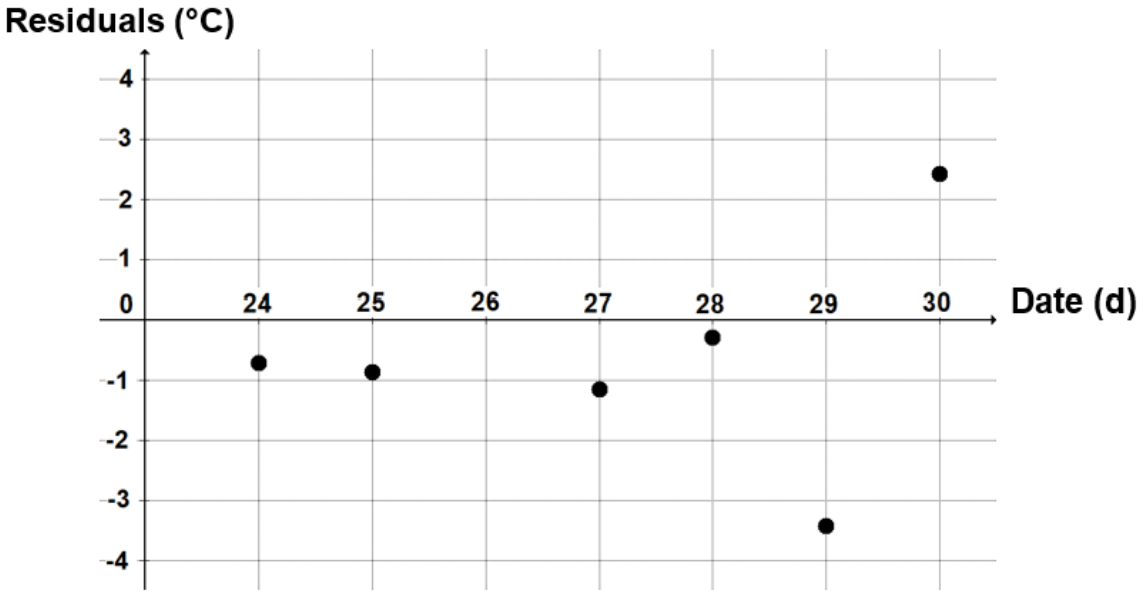


Figure 3

Question 8 a)

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5	49298	49383
6		49601
7	49596	49705
8	49609	

Table 8

Spare Diagrams

Marker use

Question 9 a)

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10	10	93	100	930
Totals:	55	578	383	3930

Table 9

Question 9 c)

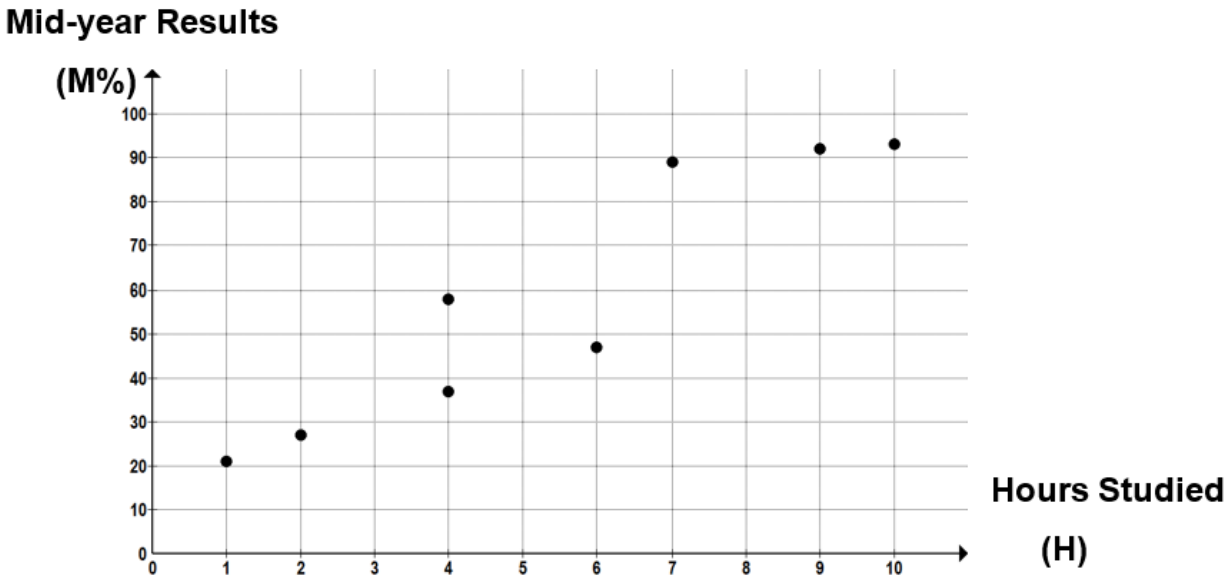


Figure 5

End of Section B



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External Assessment 2026

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GENERAL MATHEMATICS

MTG315123

Section C Growth and Decay in Sequences

Pages: 16

Questions: 5

Information Sheet: 1

Suggested working time: 36 minutes

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C6	/ 36

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Criterion

You **must** make sure your answers address:

- Criterion 6 interpret concepts and apply mathematical techniques to model patterns and solve problems involving growth and decay in sequences.

Question 11

Marker use

Farmer Brown has 100 cows on her dairy farm and plans to increase the number by 15 cows each year.

a) Write down the first few terms of the sequence, C_n, which is the number of cows n years after 2010.

/1

n	1	2	3	4	5
C_n	100				

Table 11

Spare diagram used (X) ☐

b) Write down the first term, a, and the common difference, d, for the sequence C_n.

/1

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c) Write down a sequence rule, C_n, for the number of cows after n years.

/1

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d) Using your rule, calculate the number of cows in the 12th year.

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e) In what year will the number of Brown's cows exceed 450? Use algebraic working in your answer.

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Total Q11

/6

Question 12

Marker use

Consider the sequence formed by counting the dots in Table 12:

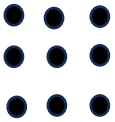
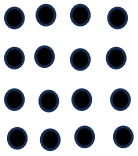
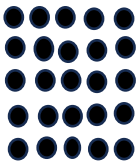
				
$t_1 = 1$	$t_2 = 4$	$t_3 = 9$	$t_4 = 16$	$t_5 = 25$

Table 12

a) Is the sequence t_n an Arithmetic Sequence? Justify your answer with calculations. /2

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b) Is the sequence t_n a Geometric Sequence? Justify your answer with calculations. /2

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Total Q12

/4

Question 13

Marker use

A fishing trawler catches 1 000 fish on its first journey, then 10% fewer each journey thereafter. This can be represented by the sequence:

$$f_n = 1000 \times 0.9^{n-1}$$

where f_n is the number of fish caught in the nth journey.

a) What does the value 0.9 represent in the sequence f_n? /1

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b) How many fish will have been caught **in total** after 10 journeys? /1

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c) How many fish will be caught **in total** if the trawler continues its journeys forever? /2

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d) How many journeys are required before less than one (1) fish is caught on each journey? What will this mean for the total number of fish caught, from this journey onwards? /3

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Total Q13 /7

Exam continues over the page

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Question 14

Marker use

Alex makes and sells figurines each week at a local market. In the first week they could sell all the figurines for $100, but each week they are forced to reduce their revenue by $8, due to competition from other figurine makers.

a) Write down an arithmetic sequence rule, R_n, to represent the revenue Alex brings in each week for selling the figurines. /2

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In the first week it cost Alex $30 to make the figurines, but they are finding that each week the cost to make the figurines increases by 20% of its previous cost.

b) Write down a geometric sequence rule, C_n, to represent the cost to make the figurines each week. /2

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.....

c) Complete Table 13 for the cost and revenue of making the figurines for the first 6 weeks. /1

Week (n)	Figurine Revenue ($\$R_n$)	Figurine Cost ($\$C_n$)
1	100	30
2	92	36
3	84	43.20
4	76	51.84
5	68	62.21
6		

Table 13

Spare diagram used (X) ☐

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Question 14 continues

Marker use

d) On the Figure 8 graph, plot the values for R_n and C_n for the first 6 weeks.

/2

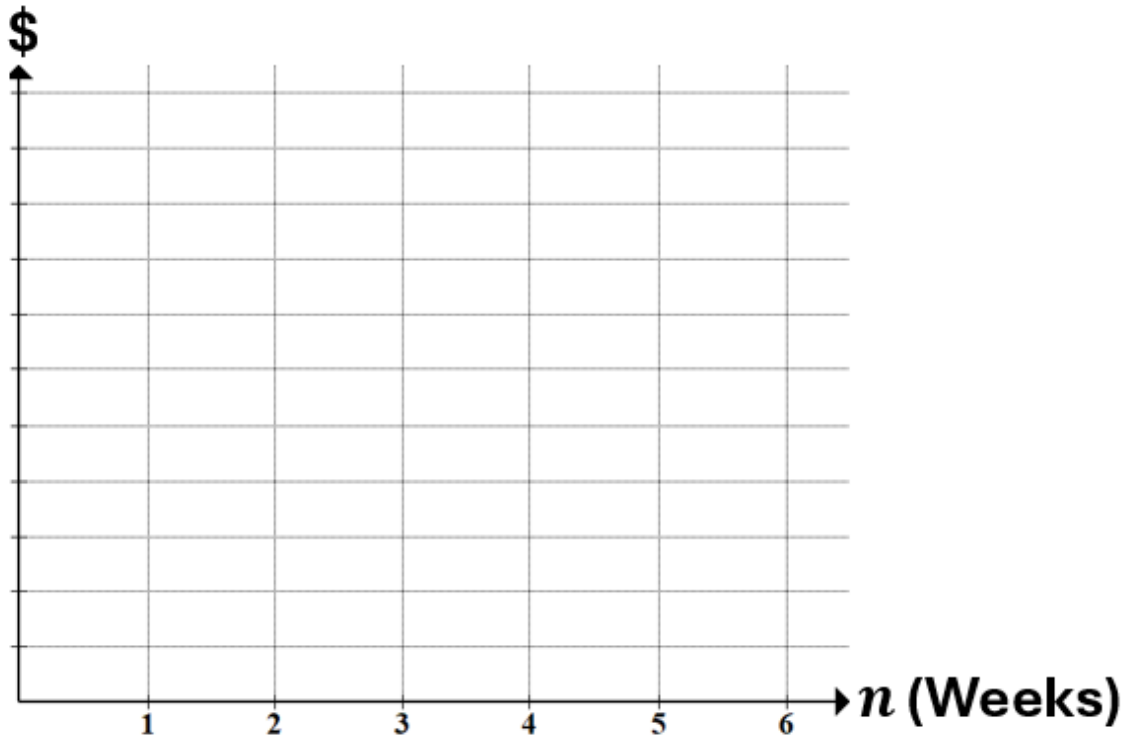


Figure 8

Spare diagram used (X) ☐

e) For how many weeks will selling figurines be profitable (i.e. the revenue is more than the cost for making the figurines)?

/1

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f) Alex does not produce figurines when they will no longer make a profit.

What is the total profit Alex made (= total R − total C)?

/3

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Total Q14

/11

Question 15

Marker use

In a small country, there was no recruiting of new police officers from the end of 1996 to the end of 2000. The numbers can be modelled by a geometric sequence, where there are 960 police in the year 1998 and 903 in the year 2000.

Year	Police Numbers at End of Year
1997	
1998	960
1999	
2000	903

Table 14

Spare diagram used (X) ☐

a)

i. Show that the common ratio for this sequence is $r = 0.970$, to 3 decimal places. /2

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ii. Write the missing values in Table 14. /1

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b) From the year 2001, the government recruits 40 police at the end of each year. If the same percentage of police still leave the force each year, write the situation as a difference equation, where $P_0 = 903$ and P_n is the number of police n years after the end of 2000. /1

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Question 15 continues

Marker use

c) Police numbers were 1 021 at the end of 1996.

In what year after 2000 will police numbers be restored to 1 021?

/2

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d) Assuming the increase of 40 police officers each year continues indefinitely, what will happen to police numbers in the long term? Justify your answer.

/2

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Total Q15

/8

Spare Diagrams

Question 11 a)

n	1	2	3	4	5
C_n	100				

Table 11

Question 14 c)

Week (n)	Figurines Revenue ($\$R_n$)	Figurines Cost ($\$C_n$)
1	100	30
2	92	36
3	84	43.20
4	76	51.84
5	68	62.21
6		

Table 13

Question 14 d)

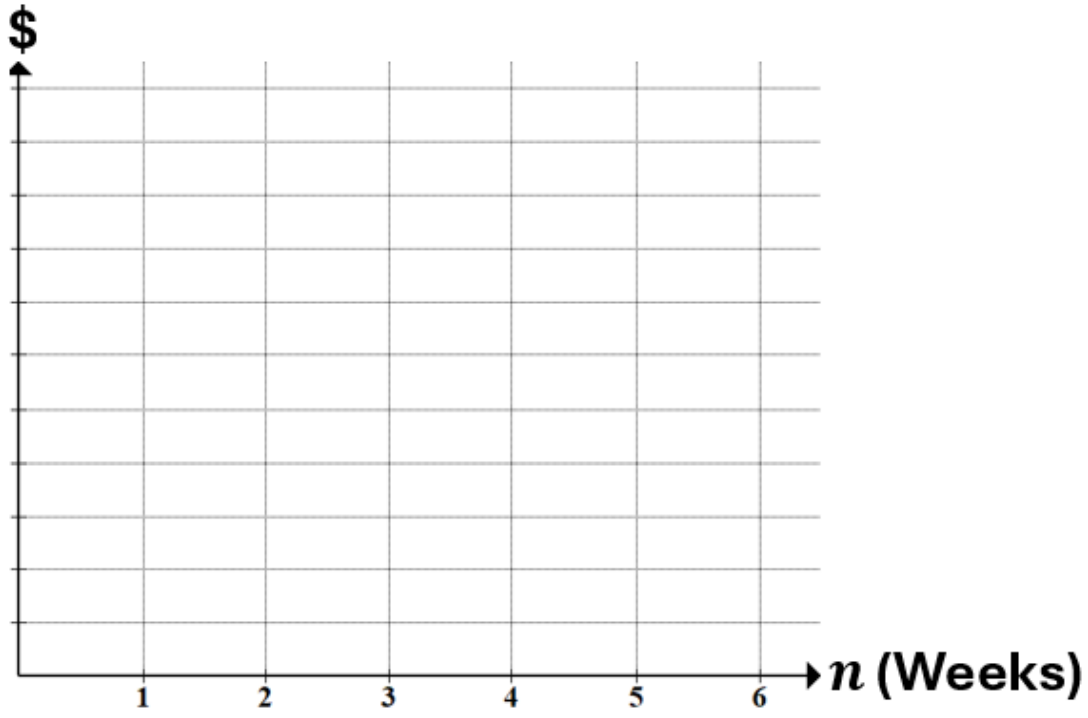


Figure 8

Spare Diagrams

Question 15 a) ii.

Year	Police Numbers at End of Year
1997	
1998	960
1999	
2000	903

Table 14

End of Section C

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GENERAL MATHEMATICS

MTG315123

Section D Finance

Pages: 16
Questions: 4
Information Sheet: 1

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
  - A spare diagram has been provided at the end of this section. Indicate using the box provided if you have used the spare diagram.
- TASC approved calculators can be used throughout the exam.
- The exam is **three (3) hours** in length. The suggested working time for this section is **approximately 36 minutes**.
- The General Mathematics Information Sheet can be used throughout the exam.
- All answers must be written in **English**.
- You **must** make sure your answers address the listed criterion.

Marker use	
C7	/ 36

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Guide to Exam Structure

	Parts	Questions available	Questions to answer	Suggested working time	Marks available
Section A		6	6	36 minutes	36 marks
Section B		4	4	36 minutes	36 marks
Section C		5	5	36 minutes	36 marks
Section D		4	4	36 minutes	36 marks
Section E	Part 1 **OR**	5	5	36 minutes	36 marks
	Part 2	4	4	36 minutes	36 marks
Totals		**28**	**24/23**	**180 minutes (3 hours)**	**180 marks**

Additional Exam Instructions

For questions worth **one (1)** mark, you are not required to show workings. Markers will look at the presentation of the answer(s) and at the argument(s) leading to the final answer(s). For questions worth **two (2)** or more marks **you are required** to show relevant workings.

Marks will be allocated:

- according to the degree to which workings convey a logical line of reasoning
- for suitable justifications and explanations of methods and processes when requested.

Criterion

You **must** make sure your answers address:

- Criterion 7 interpret concepts and apply mathematical techniques to solve problems involving standard financial models.

Question 16

Marker use

Louise wants to save $3 000 before she can go on her holiday to Bali in three (3) year's time. She currently has $2 500 to invest.

Her parents recommend a savings account that earns 4% p.a. interest, compounding fortnightly.

a) How much would Louise have saved in 3 years? /2

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b) What interest rate would she have needed, calculated fortnightly, to achieve her savings goal of $3 000 in 3 year's time? /2

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Question 16 continues

Marker use

Bank A and Bank B both offer high interest savings accounts.

Bank A offers 7.21% p.a. compounding six-monthly.

Bank B offers 7.20% p.a. compounding monthly.

c) Calculate the annual effective interest rate for both high interest savings accounts. /2

Give your answers as a percentage correct to **two (2)** decimal places.

Bank A: .....

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Bank B: .....

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Louise decides to use Bank B.

d) How many months earlier than 3 years would Louise reach her savings goal of $3 000, if she invested $2 500 with Bank B? /2

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e) Louise will invest the money for 3 years. How much less than $2 500 can she invest while still reaching her target of $3 000? /3

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Total Q16 /11

Question 17

Marker use

Jock retires with $1 200 000 in his retirement fund. He wants to withdraw $10 000 per month, from the end of the first month. The retirement fund earns 8.5% p.a. interest, calculated monthly.

a) Show that Jock's fund will last him 22 years and 5 months. /2

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b) If he wants the fund to last 25 years, use algebraic working to find his maximum possible monthly withdrawal. /3

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Question 17 continues

Marker use

c) Jock receives financial advice that if he withdraws less each month, the fund would last forever. How much is the largest amount he could withdraw for this to occur?

/2

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d) Jock really wants to withdraw $10 000 per month. What interest rate would he need to find instead, so that the fund can still last forever?

/2

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Total Q17

/9

Question 18

Marker use

Helen has been a nurse for 30 years. Each fortnight $200 has been paid into her superannuation account that has earned on average 4.5% p.a., calculated fortnightly.

a) Show that her superannuation is now $330 242.13 to the nearest cent.

/2

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Helen moves her superannuation to a new super fund that offers 5% p.a. on average, compounding six-monthly.

She will now top up her super contributions so that $10 000 is added each 6 months.

b) Write the situation with the **new** super fund as a difference equation, so that

/2

$$t_{n+1} = r(t_n + d),\ t_0 = 330\ 242.13$$

where r is the interest rate and d is the deposit by the super fund.

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c) Will she have $500 000 when she retires in 3 years?

/2

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Total Q18

/6

Exam continues over the page

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Question 19

Marker use

Kerry the farm manager bought a new tractor for $300 000.

They can depreciate the tractor using two (2) methods:

- **Reducing Balance:** Where the tractor loses 15% of its **current value** each year.
- **Straight Line:** Where the tractor loses 12% of its **original value** each year.

a) Give the equation for the depreciation of Kerry's tractor over n years using both methods. /2

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b) Calculate the value of Kerry's tractor after 3 years. Which method appears to be losing value faster after 3 years? /3

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Question 19 continues

Marker use

c) Add the straight line depreciation method to Figure 9.

/2

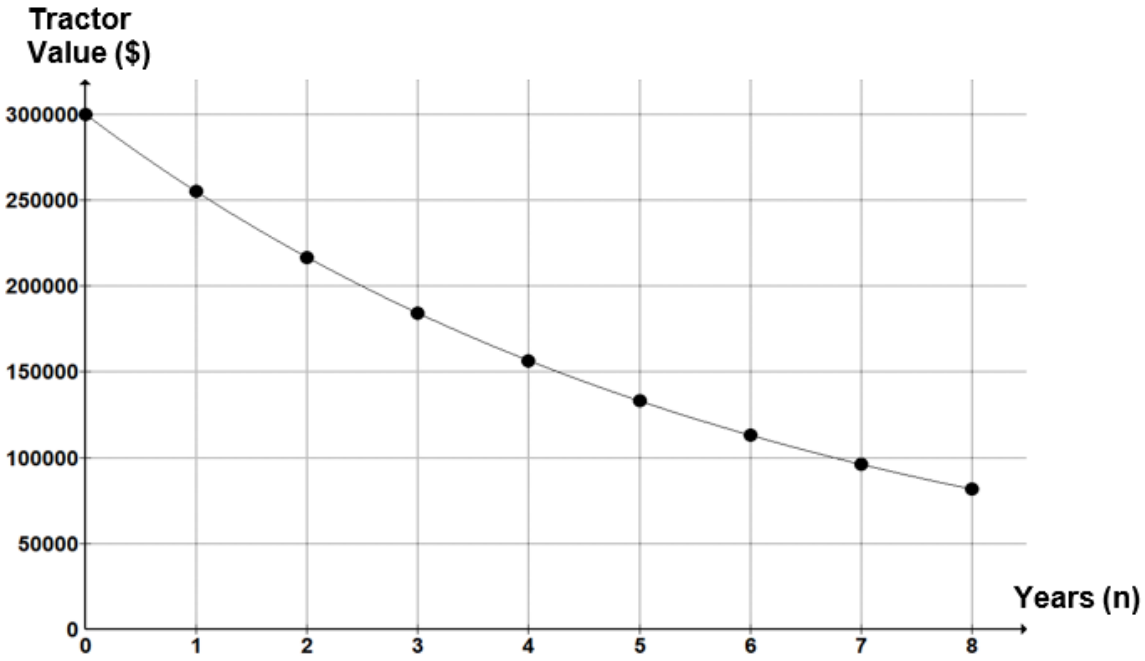


Figure 9

Spare diagram used (X) ☐

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d) Find the intersection point of the **two (2)** methods in Figure 9.

/1

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Kerry thinks they can convince the farm's owners to fund another tractor when the depreciated value of the new tractor is $100 000.

e) Calculate, using **each method** of depreciation, how many years it will take for the value of the tractor to first fall below $100 000.

/2

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Total Q19

/10

Spare Diagram

Question 19 c)

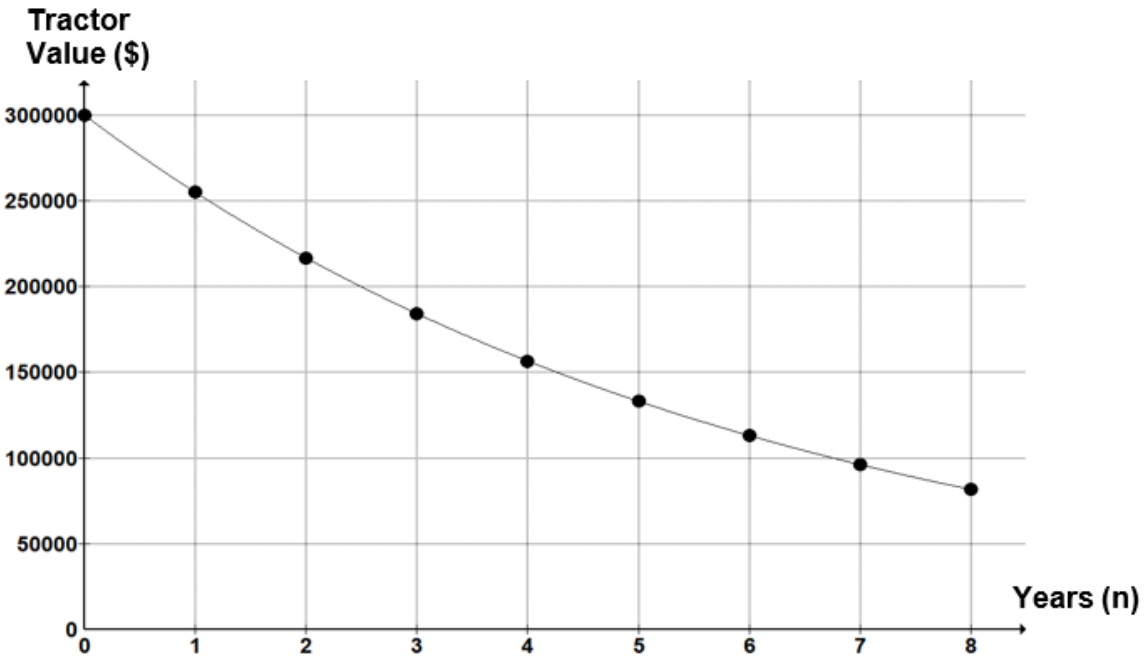


Figure 9

End of Section D

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GENERAL MATHEMATICS

MTG315123

Section E Networks **or** Trigonometry

Pages: 24
Questions: 5 / 4
Information Sheet: 1

Suggested working time: 36 minutes

Instructions:

- There are **two (2)** parts to this section. Answer **all** questions in **one (1)** part. Either:
  - **Part 1** – networks and decision mathematics

    OR
  - **Part 2** – trigonometry and Earth geometry – Part 2 commences on page 14.
- Write your answers in the spaces provided in this exam paper.
  - Spare diagrams have been provided at the end of Part 1 and Part 2. Indicate using the boxes provided if you have used the spare diagrams.
- TASC approved calculators can be used throughout the exam.
- The exam is **three (3) hours** in length. The suggested working time for this section is **approximately 36 minutes**.
- The General Mathematics Information Sheet can be used throughout the exam.
- All answers must be written in **English**.
- You **must** make sure your answers address the listed criterion.

Marker use	
C8	/ 36

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Guide to Exam Structure

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Marks will be allocated:

- according to the degree to which workings convey a logical line of reasoning
- for suitable justifications and explanations of methods and processes when requested.

Criterion

You **must** make sure your answers address:

- Criterion 8 interpret concepts and apply mathematical techniques to represent, analyse and solve practical problems in the two-dimensional plane.

Part 1 – Networks

Marker use

- Either answer **all** questions in this part **OR all** questions in Part 2.

Question 20

A homeowner is planning her annual Christmas lights display. She wants to include eight (8) different features around her house.

She looks at the lengths of cable in metres that would be needed to connect the different features, but she only needs the minimum cabling to connect each one.

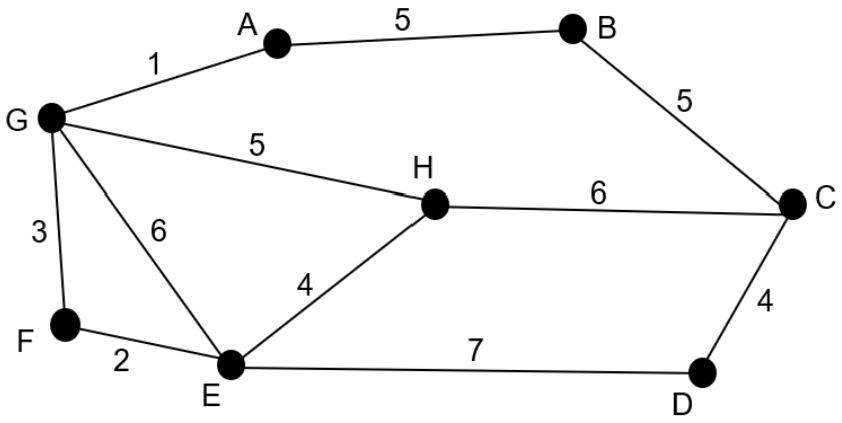


Figure 10

Spare diagram used (X) ☐

a) Complete a minimum spanning tree in Figure 10. /2

b) Calculate the minimum length of cable required in metres to connect the display. /1

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c) Using Euler's formula, confirm the network above is a planar network. /2

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Total Q20 /5

Question 21

Marker use

Figure 11 represents the precedence graph for a computer software project in hours.

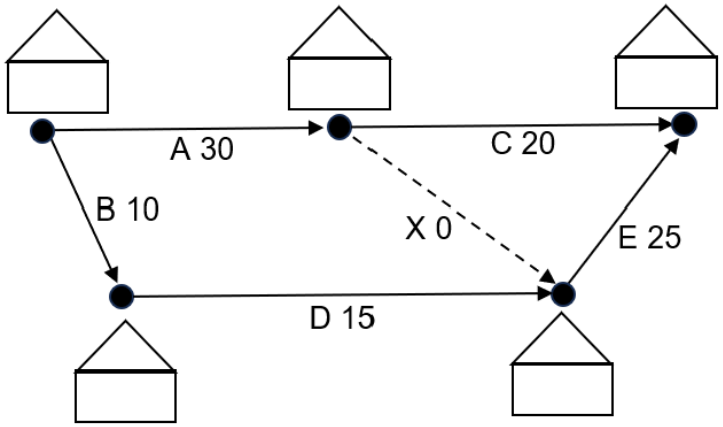


Figure 11

Spare diagram used (X) ☐

a) Give the immediate predecessors for tasks D and E.

Task D: .....

Task E: .....

/2

b)

i. Complete a forward and backward scan for the project in Figure 11.

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.....

/3

ii. State the minimum completion time for the project in hours.

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/1

c) Calculate the float time of task D.

.....

.....

/1

Total Q21

/7

Question 22

Marker use

The Log Ride is the main attraction at Euler's World, a theme park in Switzerland.

It is comprised of a series of canals that patrons travel along in boats.

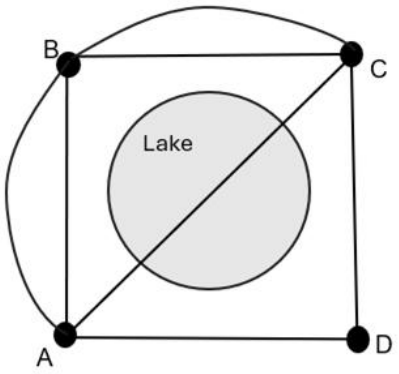


Figure 12

a) Give an Eulerian Trail starting and finishing at A for this network. /2

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b) Sharks have been discovered in the lake, so the canal from A to C has to be closed.

i. Explain why it is no longer possible for the ride to be an Eulerian Trail. /2

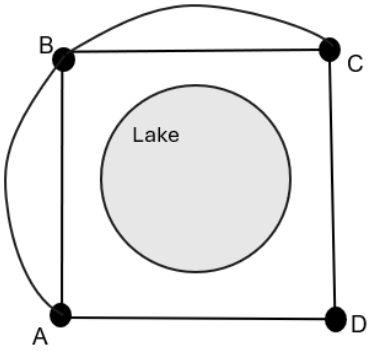


Figure 13

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Question 22 continues

Marker use

ii. The owners would like to remove another **single** canal, to ensure the ride is an Eulerian Trail. Explain why this is also not possible.

/2

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iii. The owners decide they will need to build **two (2)** more canals. It is **not possible** to install another canal from A to C or B to D. Suggest a possible way to build **two (2)** more canals and give an Eulerian Trail that is now possible.

/3

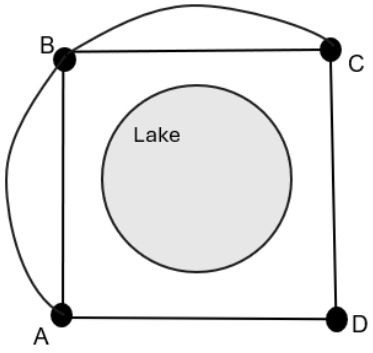


Figure 14

Spare diagram used (X) ☐

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Total Q22

/9

Question 23

Marker use

A high school is sending four teams to the national Tournament of Minds (TOM) competition. There are four (4) different categories that a team can participate in:

- The Arts (TA)
- Social Sciences (SS)
- STEM (ST)
- Language and Literature (LL).

A school can only enter one team in each of the four (4) categories.

The four (4) teams have been practising for months at each category and their best scores out of 100 are as follows:

	TA	**SS**	**ST**	**LL**
Team A	85	87	62	93
Team B	76	75	77	73
Team C	78	81	83	79
Team D	92	82	81	76

Table 15

a) Explain why the table below is an appropriate step to compute the total maximum score for the teams. /2

	TA	**SS**	**ST**	**LL**
Team A	15	13	38	7
Team B	24	25	23	27
Team C	22	19	17	21
Team D	8	18	19	24

Table 16

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.....

.....

.....

Question 23 continues

Marker use

b) Use the Hungarian Algorithm to find which team should compete in each category.

/3

1)

15	13	38	7
24	25	23	27
22	19	17	21
8	18	19	24

3)

2)

4)

Table 17

Spare diagram used (X) ☐

c) Use the bipartite graph below to allocate the best possible teams and give the maximum possible score for the team at the competition.

/3

A ● ● TA .....

B ● ● SS .....

C ● ● ST .....

D ● ● LL .....

.....

.....

Total Q23

/8

Question 24

Marker use

City F uses a large number of Thingos each year, but they do not make them. They rely on City S to supply them, through a worldwide network of cities, J to P, as well as shipping lanes. The numbers on the grid detail the number of shipping containers full of Thingos that can be transported along that route each day.

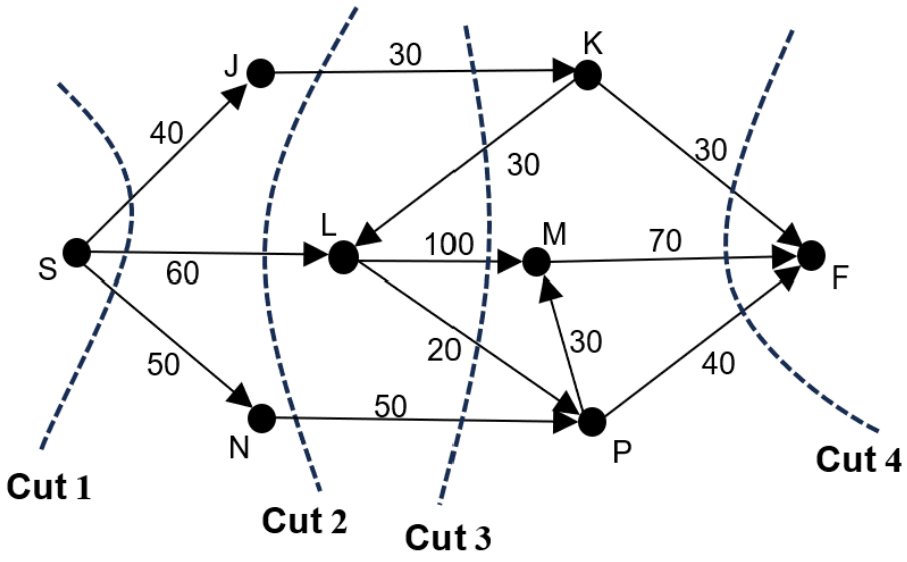


Figure 15

a)

i. Calculate the values for the **four (4)** cuts marked on the network in Figure 15. /2

Cut 1:.....

.....

Cut 2: .....

.....

Cut 3:.....

.....

Cut 4: .....

.....

ii. Based on the four (4) cuts above, what is the maximum number of shipping containers that can flow through the network each day? /1

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Question 24 continues

Marker use

Unfortunately, the shipping lane between L and M has had to be closed.

Three new cuts, Cut 5, Cut 6 and Cut 7 are the new minimum cuts for this network.

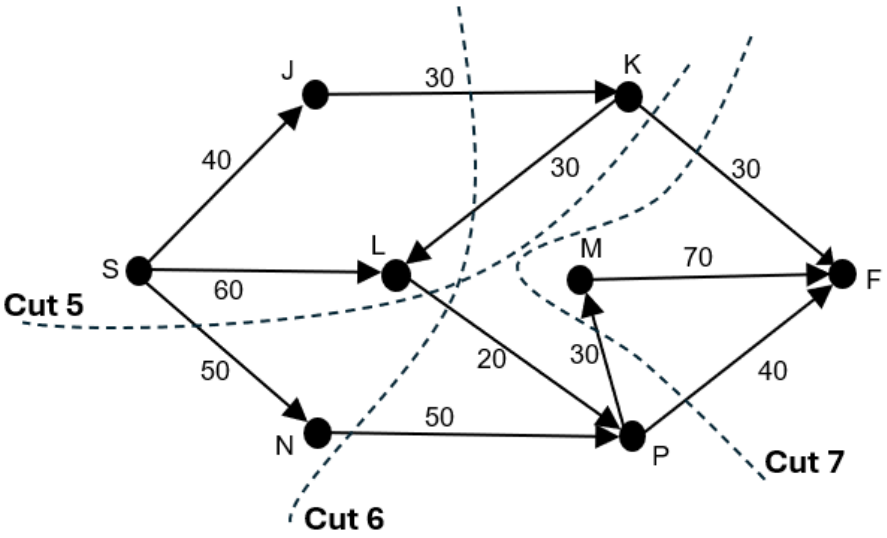


Figure 16

Spare diagram used (X) ☐

b) Explain why it is not possible to increase the flow of the network above 100 by increasing the flow of a **single lane**.

/2

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c) Identify **(2) two lanes** where the flow could be improved in order to increase the maximum flow back to the previous maximum.

/2

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Total Q24

/7

Spare Diagrams

Question 20 a)

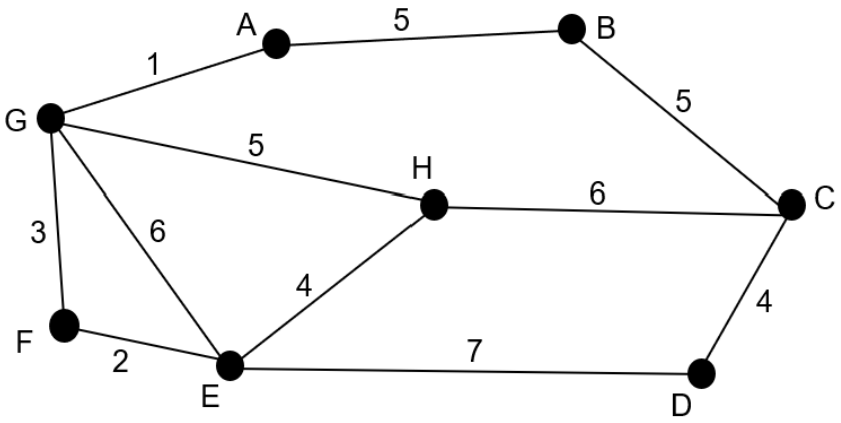


Figure 10

Question 21 b) i.

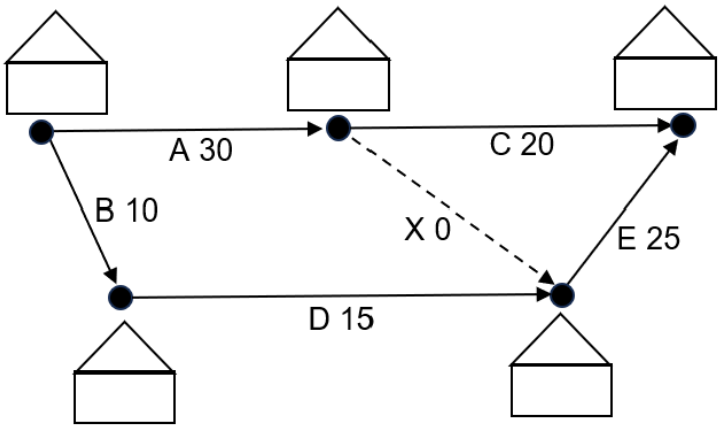


Figure 11

Question 22 b) iii.

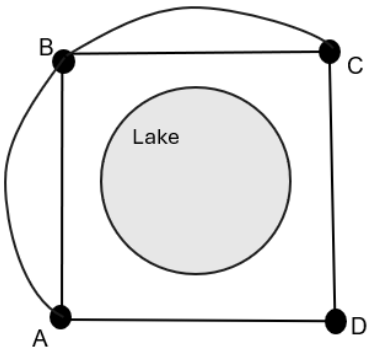


Figure 14

Spare Diagrams

Question 23 b)

1)

15	13	38	7
24	25	23	27
22	19	17	21
8	18	19	24

3)

2)

4)

Table 17

Question 24 b)

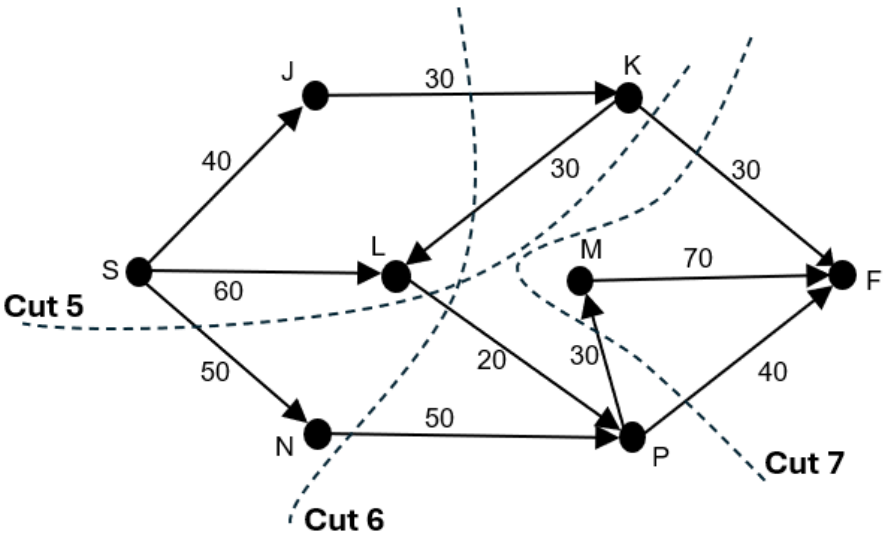


Figure 16

Part 2 – Trigonometry

Marker use

- Either answer **all** questions in this part **OR all** questions in Part 1.

Question 25

From the summit of Mount Gloom (G), Elgor the Druid (E) uses his Eldritch Hang-glider to fly 1 200 m in a straight line at an angle of depression of 20° to the ground.

In the opposite direction, Morlock the Wizard (M) flies 5 000 m on his Enchanted Carpet in a straight line from the summit to the ground.

a) Complete Figure 17 to represent the situation. /2

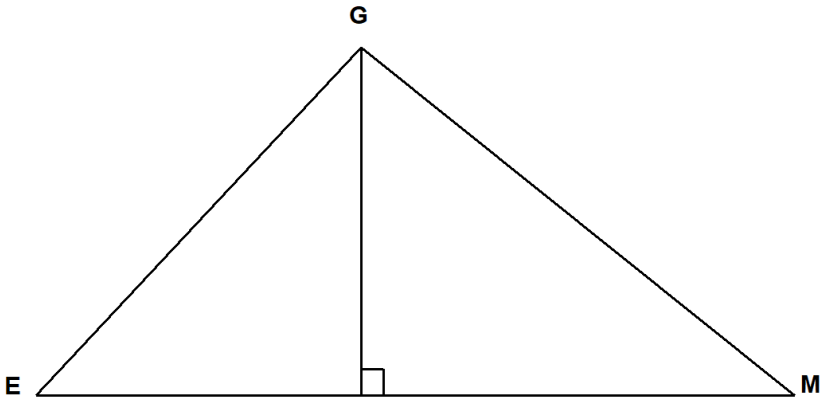


Figure 17

Spare diagram used (X) ☐

b) How high is the summit of Mount Gloom? Give your answer to **two (2)** decimal places. /2

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Question 26 continues

Marker use

c) What is the angle of depression that Morlock the Wizard used to descend from Mount Gloom? Give your answer to **two (2)** decimal places. /3

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d) When they are both on the ground, how far apart are Elgor the Druid and Morlock the Wizard? Give your answer to **two (2)** decimal places. /3

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Total Q25

/10

Question 26

Marker use

A phone app lets you 'claim' territory in the real world by running around it. Trisha starts from point A, runs 5 km North, then runs 6 km S50°E, then returns to point A.

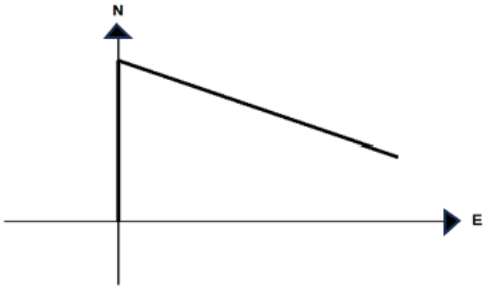


Figure 18

Spare diagram used (X) ☐

a) How far does she run on the third leg?

Give your answer to **two (2)** decimal places. Use Figure 18 to aid you if necessary. /2

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b) On what bearing does she run for the for third leg? Give your answer to the nearest degree. /3

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c) What is the area enclosed by her run? Give your answer to **two (2)** decimal places. /2

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.....

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Total Q26 /7

Question 27

Marker use

A new cable car is to be built from a base station B, to the peak of a mountain P.

From B, the peak is 2 035 m West, 1 310 m North. The straight line distance from B to P is 2 589 m. Figure 19 represents this information.

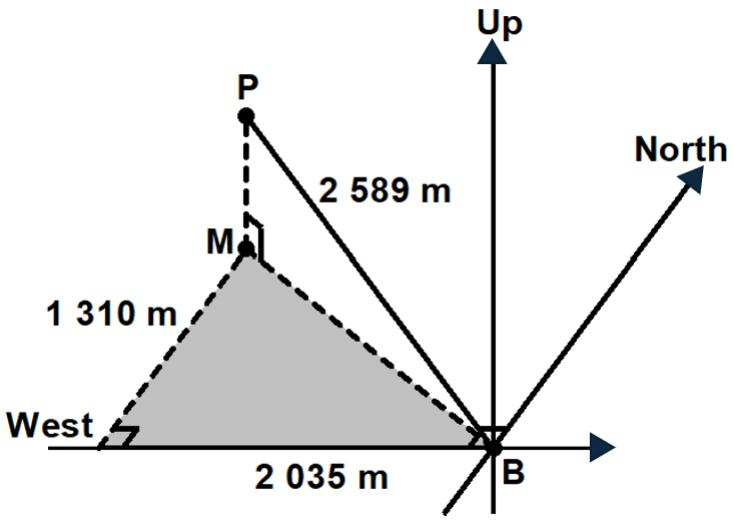


Figure 19

a) Using Pythagoras' theorem, find the distance from point B to point M, directly below the peak.

/2

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b) Using Pythagoras' theorem, your answer in item a) and the distance from B to P, find the height of the peak P above point M.

/2

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Total Q27

/4

Question 28

Marker use

The FIFA World Cup Final was held in New Jersey, USA (40.0°N, 74.4°W) at 3 pm local time, on Sunday, 19th July. Two (2) friends, one in Devonport, Tasmania (41.2°S, 146.4°E) and the other in Fort Bragg, USA (40.0°N, 123.8°W) wanted to watch the game.

a) Complete the time zones for each location (ignore any daylight savings times). /3

New Jersey: .....

.....

Devonport: .....

.....

Fort Bragg:.....

.....

b) What date and time did the match begin in Devonport and Fort Bragg? /2

Devonport: .....

.....

Fort Bragg: .....

.....

Their mutual friend, Maddy, sailed from Devonport to Fort Bragg on a cruise liner that travelled at 35 km/h following a great circle route.

c)

i. Show that the angular separation, θ, in the great circle route, is 115° to the nearest degree. /2

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.....

ii. What distance did Maddy travel? /1

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Question 28 continues

Marker use

iii. How long did the journey take?

/2

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d) When Maddy arrived in Fort Bragg, she immediately boarded a plane to New Jersey. The plane travelled **directly East** at 1 100 km/h.

How long did the flight take? Answer to the nearest minute.

/2

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e) What was the latest date and time the cruise could leave Devonport so that Maddy arrived in New Jersey when the game started?

/3

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Total Q28

/15

Spare Diagrams

Question 25 a)

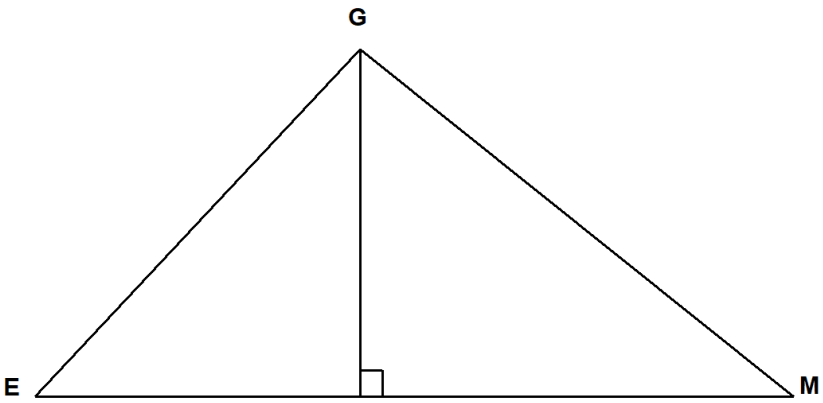


Figure 17

Question 26 a)

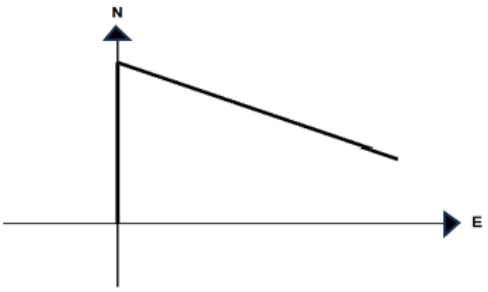


Figure 18

End of Section E

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